REMARKS

Claims 142, 147, 148, 150, 153, 156, and 158 are amended. Attached hereto is a marked-up version of the changes made to the claims by the current amendment. Claims 159 and 160 are cancelled. Claims 143, 145, 149, 153, and 157 were previously cancelled.

Claim 142 stands rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. The rejection indicates that the claim language is vague and indefinite because (1) "it is unclear what concentration is defined as 'concentration suitable for the selective removal of said residue'" since (2) "there is no guideline in the claim of how to present the conditioning solution 'in concentration suitable for the selective removal of said residue [relative] to any exposed metal." Applicant respectfully traverses this rejection.

The above indicated claim language is not indefinite, but clearly states that there should be present in the claimed conditioning solution each of the recited fluorine source, complementary acid, non-aqueous solvent, and surface passivation agent components at respective concentrations so that dry etch residue would be selectively removed by the conditioning solution relative to metal. There is nothing indefinite in the claim language. The specification provides actual examples of appropriate concentrations of these components at page 10, second paragraph, and at page 11, second paragraph. The specification also provides that "the conditioning solution can be varied to match specific applications." (page 5-6).

Additionally, there is no specific guidance in the claim directed to a method of how to present the conditioning solution, other than in solution form, because the claim is intended to cover the conditioning solution's make-up, not a method of using the solution. Related method claims have been allowed in related U.S. patent application 09/342,243. The specification provides numerous techniques by which the claimed conditioning solution may be presented for the selective removal of etch residue. For example, at page 7, second full paragraph, the specification states that suitable methods of exposing a wafer

to the conditioning solution include immersion of the wafer in a bath of conditioning solution and dispensing the conditioning solution onto a wafer as a stream or spray. Other methods of treating substrates with the conditioning solution will be apparent to those skilled in the art, as also stated in this same paragraph.

Because the language of claim 142 is clear and definite, and the subject matter defined thereby can readily be ascertained by a reading of the claim, it is in compliance with 35 U.S.C. § 112, second paragraph. Accordingly, Applicant respectfully requests that the 35 U.S.C. § 112, second paragraph, rejection of claim 142 be withdrawn.

Claims 142, 144, 146-148, 150-152, and 154-156 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. patent 5,714,203 (Schellenberger et al.) in view of U.S. patent 5,219,791 (Freidberger) and U.S. patent 6,248,704 (Small et al.). Applicant respectfully traverses this rejection.

Claim 142, as amended, defines a conditioning solution and recites, in part, "a non-aqueous solvent, said non-aqueous solvent being selected from the group consisting of tetrahydrofuran, propylene carbonate, and blends thereof." A conditioning solution such as this is not taught or suggested by Schellenberger et al., Freidberger, or Small et al., whether taken individually or in combination. None of these references discloses that tetrahydrofuran or propylene carbonate, much less a combination of the two, is useful as a solvent for a conditioning solution.

Claim 150, as amended, defines a conditioning solution configured to selectively remove residues remaining on a semiconductor substrate after a dry etch process relative to exposed metal and recites, in part, "tetrahydrofuan or propylene carbonate." For the same reasoning just discussed above in relation to the patentablility of claim 142 over the references, claim 150 is likewise patentable thereover.

Since the references do not teach or suggest each and every limitation of independent claims 142 and 150, the subject matter of these claims, as well as their depending claims 144, 146-148, and 151, 152, 154-165, respectively, would not have been obvious thereover. Applicant respectfully requests that the 35 U.S.C. § 103(a) rejection of claims 142, 144, 146-148, 150-152, and 154-156 over Schellenberger et al., Freiberger, and Small et al. be withdrawn.

Claims 158-160 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Schellenberger et al. in view of U.S. patent 5,988,186 (Ward et al.) and U.S. patent 6,261,845 (Verhaverbeke et al.). Applicant respectfully traverses this rejection.

Claim 158, as amended, defines "a conditioning solution configured to remove residues remaining on a semiconductor substrate after a dry etch process relative to exposed metal, said conditioning solution consisting essentially of: about 0.27% molecular HF and H_2F_2; about 91.5% to about 97.5% propylene glycol; about 6.5% H_2PO_4 or about 0.006% HCl; about 0.25% citric acid; and no more than about 2% water." Such a solution is not taught or suggested by Schellenberger et al., Ward et al., and Verhaverbeke et al., taken individually or in combination. More specifically, none of the references teach the claimed amounts of HF/H_2F_2 (or that this component is in molecular form), of propylene glycol, of H_2PO_4 or HCl, or the upper limit of water inclusion.

The percentages of the components of the claimed conditioning solution are not randomly assigned, but are selected so that each can provide a specific characteristic for the conditioning solution. Further the specific amounts of the components are selected to present a balanced solution so that the components interact with one another to achieve an unexpectedly advantageous selective residue removal treatment, as explained in the specification. For example, as described in the specification at pages 13-14, the selected amount of HF and H_2F_2 is appropriate to remove residue, the selected amount of complementary phosphoric or hydrochloric acid is selected to contribute to the HF and H_2F_2 remaining in substantially molecular form, and the selected amount of citric acid is

appropriate to ensure passivation of exposed metal to prevent its removal. Additionally, the amount of water in the solution is limited to be as little as possible, as discussed in the specification at pages 11-12.

Because the references do not teach or suggest the claimed solution composition and the advantages of the composition are unexpected, claim 158 is patentable thereover. Applicant respectfully requests that the 35 U.S.C. § 103(a) rejection of claim 158 over Schellenberger et al., Ward et al., and Verhaverbeke et al. be withdrawn.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

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Respectfully submitted,

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Version With Markings to Show Changes Made

142. (Four Times Amended) A conditioning solution [for use in removing residues remaining on a semiconductor substrate after a dry etch process, said conditioning solution] comprising:

a fluorine source, said fluorine source being selected from the group consisting of hydrofluoric acid, ammonium fluoride, and other fluorine donating chemicals;

a [complimentary] complementary acid, said [complimentary] complementary acid being selected from the group consisting of phosphoric acid, hydrochloric acid, and combinations thereof;

a non-aqueous solvent, said non-aqueous solvent being selected from the group consisting of [ethylene glycol] tetrahydrofuran, propylene carbonate, and blends thereof; and

a surface passivation agent, [said passivation agent comprising ascorbic acid,] wherein

[said conditioning solution is substantially free of water, and] said fluorine source, said [complimentary] complementary acid, said non-aqueous solvent and said passivation agent are present in said conditioning solution in concentrations suitable for the selective removal of said residues relative to any exposed metal on said semiconductor substrate.

147. (Twice Amended) The solution of claim 146, wherein said [complimentary] complementary acid is present in sufficient amount to contribute to said fluorine source substantially remaining in molecular form.

148. (Twice Amended) The solution of claim 142, wherein said fluorine source, said [complimentary] complementary acid, said passivation agent, and said non-aqueous solvent are present in said solution in sufficient concentrations to suppresses the solubility of aluminum fluoride.

150. (Four Times Amended) A conditioning solution [for use in removing] configured to selectively remove residues remaining on a semiconductor substrate after a dry etch process relative to exposed metal, said conditioning solution comprising:

hydrofluoric acid or ammonium fluoride;

hydrochloric acid or phosphoric acid;

[ethylene glycol] tetrahydrofuan or propylene carbonate; and

ascorbic acid or ethylene diamine tetraaceitic acid acting as a surface passivation agent.

154. (Twice Amended) The solution of claim 150, wherein said hydrofluoric acid or ammonium fluoride [contributes to] are configured for said selective removal by said solution [by] in that they remain substantially [remaining] in molecular form.

156. (Twice Amended) The solution of claim 150, wherein said hydrofluoric acid or ammonium fluoride, said hydrochloric acid or phosphoric acid, said ethylene glycol or propylene carbonate, and said ascorbic acid are present in said solution in sufficient concentrations to suppress[es] the solubility of aluminum fluoride.

158. (Four Times Amended) A conditioning solution [for use in removing] configured to remove residues remaining on a semiconductor substrate after a dry etch process relative to exposed metal, said conditioning solution consisting essentially of [a fluorine source, a complementary acid, a non-aqueous solvent and a surface passivation agent, wherein

said conditioning solution is substantially non-aqueous and is selective to removal of said residues relative to metal lines exposed over surfaces of said semiconductor substrate] :

0.27% molecular HF and H_2F_2;

91.5% to 97.5% propylene glycol;

6.5% H_2PO_4 or 0.006% HCl;

0.25% citric acid; and

no more than 2% water.